

SUPPLY NETWORK DISRUPTION DYNAMICS MODEL

MODEL OVERVIEW

Supply networks for firms and industries are interdependent pathways that can transmit disruptions globally. Modern logistics systems allow for small inventories, making operations efficient, but concentrated production and just-in-time operation create potential for disruptions to become severe and spread widely. Understanding whether protective measures, such as backup suppliers, can be overwhelmed and how extensive and persistent the consequences might be is important for increasing network security and resilience. The National Infrastructure Simulation and Analysis Center's (NISAC's) SupplyNet model integrates network data and process models to estimate flows of goods and services through supply networks, accounting for uncertainties from missing data and relationship dynamics. By studying responses to possible disruptions, such as loss of production facilities, transportation assets, or border closure, analysts can help focus attention on high-consequence possibilities and assess strategies for reducing risk.

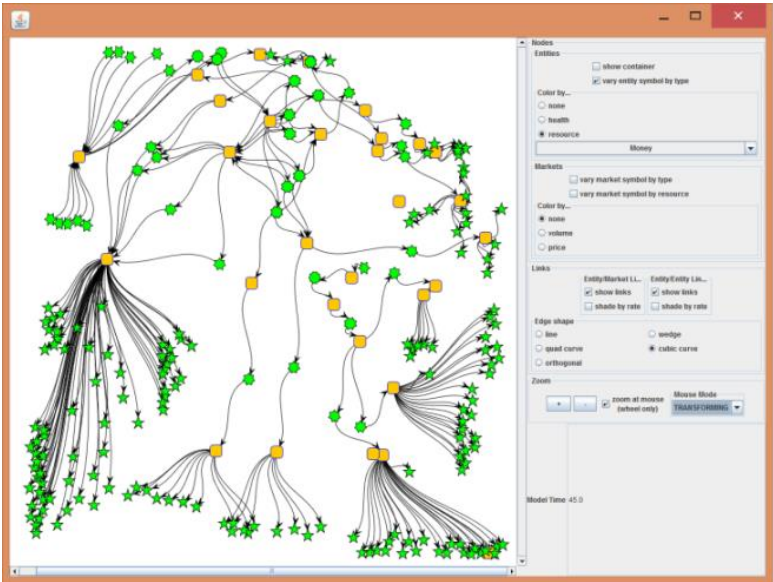


MODEL CHARACTERISTICS

- ▶ Organizes system data for viewing and analysis by many different tools.
- ▶ Scalable to national, state, or regional level.
- ▶ Models flow and transformation of diverse products among the parts of the network selected for analysis.
- ▶ Models the effect of disruption in production, importation, or transport on downstream product availability.
- ▶ Includes uncertainty in the structure or properties of the network by simulating alternative possibilities.

OUTPUT

- ▶ Amount and quality of goods in the network as a function of time.
- ▶ Probability that disruption will lead to downstream shortages.
- ▶ Disruptions most likely to produce shortages of specific goods.



MODEL APPLICATIONS

- ▶ Food contamination tracing (Bloodhound)
- ▶ Petrochemical supply network disruption.
- ▶ Border closure impacts on pharmaceutical and computer component manufacturing supply networks.



QUESTIONS ADDRESSED

Given basic information about production processes and data about the specific firms that perform these processes, NISAC can answer the following types of questions:

- ▶ What are the possible outcomes of disruption or contamination at various locations in the network?
- ▶ Where would additional resources (supplies, pathways) be most effective in preventing severe consequences?
- ▶ What actions might mitigate unacceptable risks?
- ▶ Can inbuilt adjustments and mitigations resolve problems within the network?
- ▶ Will problems resist or be amplified by the normal reactions of the network, creating large, persistent shortages?

ABOUT OCIA

The Department of Homeland Security, National Protection and Programs Directorate's (NPPD) Office of Cyber and Infrastructure Analysis (OCIA) manages NISAC, which is a Congressionally mandated center of excellence in modeling, simulation, and analysis of critical infrastructure.

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